

US-PAT-NO: 6697350

DOCUMENT-IDENTIFIER: US 6697350 B2

TITLE: Adaptive vector  
correlator for spread-spectrum  
communications

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Detailed Description Text - DETX (28):

The APC data rate is sent at 64 kbs. The APC logical channel is not FEC coded to avoid delay and is transmitted at a relatively low power level to minimize capacity used for APC. Alternatively, the APC and OW may be separately modulated using complex spreading code sequences or they may be time division multiplexed.

Detailed Description Text - DETX (49):

Second, a method of transmitting complex valued spreading codes (in-phase (I) and quadrature (Q) sequences) in a pilot spreading code signal may be used rather than transmitting real valued sequences. Two or more separate spreading codes may be transmitted over the complex channels. If the codes have different phases, an acquisition may be done

by acquisition circuits in parallel over the different spreading codes when the relative phase shift between the two or more code channels is known. For example, for two spreading codes, one can be sent on an in phase (I) channel and one on the quadrature (Q) channel. To search the spreading codes, the acquisition detection means searches the two channels, but begins the Q channel with an offset equal to one-half of the spreading code length. With code length of  $N$ , the acquisition means starts the search at  $N/2$  on the Q channel. The average number of tests to find acquisition is  $N/2$  for a single code search, but searching the I and phase delayed Q channel in parallel reduces the average number of tests to  $N/4$ . The codes sent on each channel could be the same code, the same code with one channel's code phase delayed or different spreading codes.

#### Detailed Description Text - DETX (144):

One embodiment of the current invention includes an adaptive matched filter (AMF) to optimally combine the multipath signal components in a received spread spectrum message signal. The AMF is a tapped delay line which holds shifted values of the sampled message signal and combines these after correcting for the channel response. The correction for the channel response is done using

the channel response estimate calculated in the AVC which operates on the pilot sequence signal. The output signal of the AMF is the combination of the multipath components which are summed to give a maximum value. This combination corrects for the distortion of multipath signal reception. The various message despreading circuits operate on this combined multipath component signal from the AMF. FIG. 8d shows an exemplary embodiment of the AMF. The sampled signal from the A/D converter 870 is applied to the L-stage delay line 872. Each stage of this delay line 872 holds the signal corresponding to a different multipath signal component. Correction for the channel response is applied to each delayed signal component by multiplying the component in the respective multiplier of multiplier bank 874 with the respective weighting factor  $w_{\text{sub}.1}$ ,  $w_{\text{sub}.2}$ , . . . ,  $w_{\text{sub}.L}$  from the AVC corresponding to the delayed signal component. All weighted signal components are summed in the adder 876 to give the combined multipath component signal  $y(t)$ .

#### Detailed Description Text - DETX (149):

A second advantage of the method of reducing re-acquisition by virtual locating is that a conservation in SU power use can be achieved. Note that a

SU that is "powered down" or in a sleep mode needs to start the bearer channel acquisition process with a low transmit power level and ramp-up power until the RCS can receive its signal in order to minimize interference with other users. Since the subsequent re-acquisition time is shorter, and because the SU's location is relatively fixed in relation to the RCS, the SU can ramp-up transmit power more quickly because the SU will wait a shorter period of time before increasing transmit power. The SU waits a shorter period because it knows, within a small error range, when it should receive a response from the RCS if the RCS has acquired the SU signal.

Detailed Description Text - DETX (267):

The SU modem monitors, at step 2406, the FBCH AXCH traffic light. When the AXCH traffic light is set to red, the SU assumes the RCS modem has acquired the SAXPT and begins transmitting LAXPT. The SU modem continues to ramp-up power of the LAXPT at a slower rate until sync-ind messages are received on the corresponding CTCH. If the SU is mistaken because the traffic light was actually set in response to another SU acquiring the AXCH, the SU modem times out because no sync-ind messages are received. The SU randomly waits a period of time, picks a new AXCH channel, and steps 2404 and 2405 are repeated until

the SU modem receives sync-ind messages. Details of the power ramp up method used in the exemplary embodiment of this invention may be found in Section CDMA Systems By Using Short Codes."

Detailed Description Text - DETX (346):

The RCS does not use traffic lights to block new users who have finished ramping-up using the short codes. These users are blocked by denying them the dial tone and letting them time out. The RCS sends all 1's (go down commands) on the APC channel to make the SU lower its transmit power. The RCS also sends either no CTCH message or a message with an invalid address which would force the FSU to abandon the access procedure and start over. The SU, however, does not start the acquisition process immediately because the traffic lights are red.

Detailed Description Text - DETX (378):

The rate that the SU 3116 increases transmission power to avoid overshoot may be reduced, however, this results in a longer call setup time. Those of skill in the art would appreciate that adaptive ramp-up rates can also be used, yet these rates have shortcomings and will not appreciably eliminate power overshoot in all situations.

Detailed Description Text - DETX (400):

The time distribution of acquisition opportunities is shown in FIG. 43 for a typical prior art SU located 20 km from a BS in a 30 km cell. For a BS which tests 8 code phases simultaneously at a PN rate of 12.48 MHz and a symbol rate of 64,000 symbols per second and takes an average of 7.5 symbol periods to accept or reject a particular group of code phases, the average time to test all code phase delays within the cell is approximately 37 msec, and any one SU can only be detected during an approximately 100 .mu.sec window during that period. Assuming that the selection of initial SU transmission power level is 15-20 dB below the proper level and a slow ramp-up rate of between 0.05 and 0.1 dB/msec, it could take 4-5 such 37 msec time periods, (or an average of approximately 200 msec,) for the BS to acquire a SU. This introduces an unacceptable delay in the channel establishment process which should be less than 150 msec. Accordingly, there is a need to reduce the amount of time required for a BS to acquire an SU.

Detailed Description Text - DETX (401):

The present invention includes a method of reducing the re-acquisition time of a fixed SU by a BS in a CDMA communication system by utilizing virtual

locating of the SU. A BS acquires SUs by searching only those code phases concomitant with the largest propagation delay possible in the cell, as if all SUs were located at the periphery of the cell. An SU which has never been acquired by the BS varies the delay between the PN code phase of its received and transmitted signals over the range of possible delays in a cell and slowly ramps-up its transmission power until it is acquired by the BS. Upon initial acquisition by the BS the SU ceases ramping-up its power and varying the delay and internally stores the final value of the delay in memory. For subsequent re-acquisition, the SU adds the delay value between the PN code phase of its received and transmitted signals, making the subscriber virtually appear to be at the periphery of the cell. This permits a quick ramp-up of transmission power by the SU and reduced acquisition time by the BS.